



Efficacy Of Cleaning Stethoscope With Disinfectants Among Health Care Workers In A Tertiary Care Centre.

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ABSTRACT

AIMS:

The prevalence of hospital acquired infection is high and remains as a major health problem in both national and global level. This study was done to find out the contamination percentage of stethoscopes and the efficacy of cleaning stethoscopes with disinfectants among health care workers in a tertiary care centre.

METHODOLOGY AND RESULTS:

This was a cross sectional study conducted in the department of Microbiology, Saveetha medical college Hospital and Chennai from health care workers. Stethoscopes of 100 volunteered health care workers were included in the study. Samples were collected from different parts such as diaphragm, bell and ear piece by using sterile swabs soaked in sterile saline. The collected samples were processed by standard microbiological procedures.(CLSI). Among 100 stethoscopes 26(26%) has admitted that they have never cleaned their stethoscope and their contamination rate is 100%. Out of the total 100 stethoscopes, 79 (79%) stethoscopes were colonized with different pathogenic bacteria. Among 79 contaminated stethoscopes 60(60%) diaphragms showed predominant colonization, whereas only 55 (55%) bells and 35(35%) ear pieces were only contaminated among them. Mixed growth was seen in diaphragms (n=1) and bell (n=3). The bacteria that were isolated from diaphragm, bell and earpiece are *Staphylococcus aureus*, *Coagulase negative Staphylococcus aureus*, *Micrococcus*, *Diphtheroids*, *Pseudomonas aeruginosa*, *K.pneumoniae*, *Citrobacter freundii*. Among these bacteria drug resistance organisms such as *MRSA*, *MRCNS* and *MDR P.aeruginosa* were also isolated.

CONCLUSION:

Stethoscopes used by HCWs may behave as carriers of hospital diseases since they are contaminated with the pathogenic bacteria. Regular cleaning of the stethoscope with 70% ethanol will help to prevent the transmission of microorganisms and the contaminants. HCWs must strictly adhere to the hospital's disinfection procedures in order to avoid cross contamination and assure patient safety. So, we need to impart knowledge and motivate the HCWs and should be added as one of the strict policy in hospital infection control manual.

Key words: Hospital acquired infection, Disinfection, stethoscope, health care workers,MDR

INTRODUCTION:

Stethoscopes are a critical and essential tool in the medical field, used by Doctors, Nurses, and other healthcare professionals to diagnose and monitor patients. (Priya Datta et al 2018). However, they are also a potential

source of contamination, with studies showing that stethoscopes can carry harmful bacteria and viruses, including MRSA, E coli and influenza. **(Sangita Thapa et al 2017)**

To minimize the risk of stethoscope contamination, it is essential to follow proper disinfection protocols. This involves cleaning the surface of the stethoscope and applying an appropriate disinfectant.

One of the most effective disinfectants for stethoscopes is an alcohol-based solution, such as 70% isopropyl alcohol. **(Waghorn DJ et al 2005; Sangita Thapa et al 2017)**. This type of solution can quickly kill bacteria and viruses on contact and is easy to apply. Simply spray or wipe down the stethoscope with the alcohol solution and let it air dry completely before using it on another patient.

It is important to note that not all stethoscopes are the same and some materials may not be compatible with certain disinfectants. Always check the manufacturer's guidelines for cleaning and disinfecting your stethoscope. In addition to using a disinfectant, healthcare professionals should also practice good hand hygiene and avoid touching their stethoscope frequently while examining patients. **(Md.Azizul Haque, Khandaker Md. et al 2017)** They should also regularly clean and disinfect their stethoscope especially after examining patients with a communicable disease.

MATERIALS AND METHODS

This prospective study was conducted in Department of Microbiology at Saveetha institute Of Medical and Technical sciences; Thandalam.

Collection of samples:

A total of 100 participants were participated in study. After getting an informed consent, to assess their knowledge and cleaning practices regarding stethoscope disinfection, a questionnaire based cross sectional study was conducted among the medical personnel working in active patient care hospital in India. Stethoscopes of all 100 healthcare workers, who consented from different departments and categories, were included in the study.

Bacteriological analysis:

Swabbing of diaphragm, bell and ear piece of the participants were done using a sterile cotton swab moistened with sterile normal saline. Six swabs were collected from their stethoscope, before and after using it on the patient. Initial three swabs (one from diaphragm, one from bell and one from ear piece) was collected before cleaning their stethoscopes with an alcohol based disinfectant and remaining three other swabs (one from diaphragm, one from bell and one from ear piece) was collected after cleaning it with alcohol based disinfectant. The collected swabs were then cultured on nutrient agar, MacConkey agar, and Blood agar and incubated at 37°C for 24 hours. Identification was done based on Gram's staining report and standard biochemical test (Catalase test, Oxidase test, Coagulase test, Indole test, methyl red test, voges-proskauer test, mannitol motility medium, Citrate utilization test, triple sugar iron agar, urease test and bile esculin test). After identification of the bacteria, drug resistance was performed cefoxitin for *S.aureus* and Amikacin, Gentamicin, Ciprofloxacin, Piperacillintazobactam, Meropenem, Co trimoxazole for *Pseudomonas aeruginosa*.

RESULTS:

Among the 100 stethoscopes, 8 were collected from Consultants, 39 from Residents, 27 from Interns, 20 from Staff nurse, 6 from other health care workers which include ECG technicians etc. Fig.1 shows the distribution of the health care workers. Analysis of questionnaire given to them showed that 80% of them believed that stethoscopes are potential vector for carrying pathogenic organisms from one person to other person. Twenty six individuals (26%) had never cleaned their stethoscopes. Eleven individuals (11%) has cleaned their stethoscopes monthly once, twenty two individuals (22%) has cleaned their stethoscopes weekly once, followed by eighteen individuals (18%) on alternate days and twenty three individuals (23%) on daily basis. Table 1 shows the distribution of cleaning practices of the stethoscopes and correlation with the contamination rate using questionnaire analysis. Among the 74 individuals whose answered to clean their stethoscopes, the majority participants (70/74 individuals) answered that they used sterillium as cleaning and disinfecting agent while other 4/74 individuals have used Chlorhexidine. Table2. Represents the distribution of organisms isolated from the contaminated stethoscope. From diaphragm MRSA (22%) and MCONS (20%) was predominantly isolated followed by MSSA (27%) and *Micrococci* (22%) from bell, whereas from ear piece *Diphtheroids* (29%) was predominantly isolated. . Fig. 2 shows the representation of different organisms from the stethoscope. The screening of drug resistance among the isolated microorganism showed 31.6% of organisms were MDR in diaphragm 24% of organisms was MDR in bell and 31.5% of organisms was MDR in ear piece. Fig.3 shows the representation of the multi-drug resistance organisms in stethoscope.

DISCUSSION

Hospitals provide a favorable environment for the growth of bacteria that colonize different medical devices and are pathogenic, drug-resistant microorganisms. This was concordance with **PriyaDatta,**

MandeepKaur, SangeetaRawat et al. The occurrence of Hospital Acquired Infections has become worldwide because of widespread use of medical devices for diagnosis and treatment which was similar to **Jeyakumari D et al.** Every year, 5–10 nosocomial infections occur for every 100 hospital admissions. **Alothman A, Bukhari et al.** Stethoscope serves as one of the salient medical device in medical field and hence it serves as an important vector for the transmission of microorganism if not disinfected properly, because of its increased frequency of utilization (**Adesanya. O et al**). Though Stethoscope is commonly used instruments by the health care workers in their daily medical practice, the cleaning rate among health care workers in various studies is very low; the contamination percentage is also high as it comes in contact with remarkably large numbers of patients.

In our study the majority proportion of sample is taken from residents and interns as they are the major category who handles patients every day. In our study the contamination rate ranged from 72% among residents, 81 % among interns , 100% and 75% among nurses and consultants respectively, whereas only the students contamination rate was comparatively lesser which is 50% reflecting that could be due to less handling in patients and their contamination could be due to their own skin flora. This was in concordance to the study conducted by **Chigozie Jet al** which showed contamination rate in Physician's was 80%. Due to many reasons the difference in level of contamination of stethoscopes among doctors, nurses and students has varied. Some possible reasons could be usually doctors possess their own personal stethoscopes whereas staff nurse share their stethoscopes frequently in wards and as the awareness and importance of microorganism are less to some nurses and also due to their higher workload, the practice of cleaning and disinfection among them used to be very low. In this current study, all the doctors and interns usually use their own stethoscope and nursing staff were not in possession of their individual stethoscopes and used the stethoscope available in the ward. The chances of microbial contamination will be higher which depends upon the number of persons handling per day. On the other hand, nurses in their routine duty may follow irregular disinfecting or cleaning the medical devices which causes microbial colonization. This could be the reason why in our study although the rate of contamination among stethoscopes used by nursing staff was higher (100%) followed by interns (81%), Doctors (75%) and students (50%). None of the staff nurses have practice of disinfecting in between patients. These results in concordance with the study by **Adesanya. O et al** ,**SangeetaRawat et al**. But in the study conducted by **Chigozie Jet al**, the physician's contamination rate was higher than nurses. Our study showed 80% contamination rate. These findings are consistent with another study by **Nigeria Chigozie J et al** who also reported contamination rate of 79%, whereas a much lower contamination rates (19% to 42%) had also been reported by **Md. AzizulHaque et al.** and **Adesanya. O et al**. The study conducted in Buckinghamshire by **Waghorn DJ et al** have reported 100% contamination rate. Generally stethoscopes are contaminated by the normal flora present on the hands of HCWs and from the surface they come in contact with. In our study in almost all the wards the contamination rate is higher which in turn highlights the mandatory and urgent need to spread the awareness for stethoscope cleaning in hospital.

In our study the contamination of stethoscope is predominantly with the Gram positive organisms which indicate that transmission is from hand or their garment or any surface.

The findings from our study indicates that the stethoscope may act as a vector in the transmission of potentially pathogenic bacteria as well as in the spread of antibiotic-resistant strains in the healthcare setting which was similar to other study by **Marinella MA, et al**

The present study reported that diaphragms were significantly more colonized (80%) than bell portions (70%) and ear piece (42%) of the stethoscopes. 42% of the earpieces were contaminated but it does not play any significant role in the transmission of bacteria since they lack direct contact with the patient's skin (**SangitaThapa et al and Adesanya. O et al**)

As the diaphragm of stethoscope has a larger flat surface which frequently comes in contact with patient's skin and clothes. The bell because of its smaller surface area has less chances of bacterial colonization. This was similar to another study by **SangitaThapa et al**

Our study showed that Gram positive bacteria (40%) was the predominant species isolated, followed by *Diphtheriods* (25%), whereas only 12 % were Gram negative bacilli in which *Citrobacterfreundii*(8%) and *Pseudomonas aeruginosa* (4%) was isolated. The Gram positive cocci were isolated predominantly because of the direct contact of stethoscopes to human skin flora, which contains mostly Gram positive cocci as commensal.

In our study different hospital areas were colonized with varied microbial flora. Maximum contamination was seen in chest medicine (90%) department, general medicine department and obstetrics and gynecology department (88% & 83%) in turn reflecting the higher case load; hence the contamination rate could be higher. And also even the high risk areas such as Emergency department and anesthesia (75%) and critical care department (67%). even though lower than the previously mentioned areas, but more than 50 % contamination which reflecting that chance of Hospital acquired infection may in turn increase , which alarms the urgent need of strict infection control in the hospital. **Khalid Ahmed et al, SaifullahShaikh et al study** also showed that higher rate of contamination among general medicine and Obstetric department but comparatively lesser contamination in high risk areas, which is discordance with our study.

The efficacy of cleaning of stethoscope using (95%) sterilium showed zero contamination (100%), but the study done by **AgamBansal, Sarath R S et al** showed growth even after disinfection with alcohol based disinfectant which is not concordance to our study.

Many studies revealed that the drug resistant organisms like MRSA, VRE and ESBL have been isolated from the stethoscopes in the study by **Jeyakumari D et al. Int J Res Med Sci. 2017.** Our study also showed that in *S.aureus* (53%) out of which MRSA (24%) and MRCONS (16%) were isolated (**Jeyakumari D et al Int J Res Med Sci. 2017.**)

The HCWs in these areas should adhere to infection control practices especially hand hygiene which will reduce the chances of contamination of medical devices. The heavy rush of patient in emergency wards, wards, and OPD's can result in higher rate of contamination due to multiple sharing of the stethoscopes and paucity of time.

CONCLUSION

A stethoscope is an important diagnostic tool for diagnosis of patients but at the same time if it is not disinfected properly it can act as a vehicle for transmission of infection including MDR pathogens. Our current study has proved that stethoscope can transmit pathogenic and non- pathogenic organisms from one patient to another. This study shows that diaphragm and bell portion of stethoscope are highly contaminated which means risk of transmission of microorganisms is more. These complications can be overcome by following simple methods such as hand hygiene and disinfecting medical devices after the use of each patient mandatorily and should be added as one of the strict policy under infection control manual. In addition to that training and IEC should be provided for all health care workers irrespective of their categories. Stethoscope as a tool for transmission of microorganism can be controlled by regular surveillance and conducting regular programs on hospital infection control

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Fig 1 shows the distribution of the Health care workers

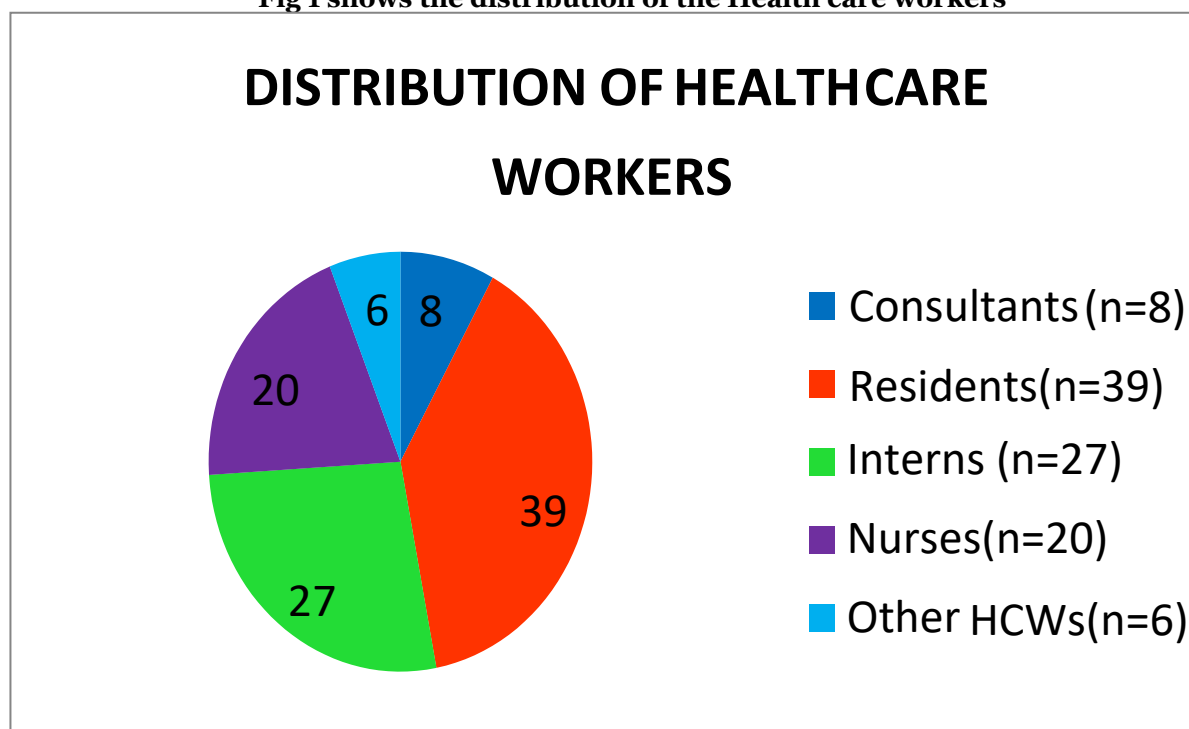


Table 1: Distribution of cleaning practices of the stethoscopes and correlation with the contamination rate using questionnaire analysis

	No. of HCWs answered	No. of stethoscope contaminated
<u>Frequency of disinfecting stethoscopes</u>		
Daily	23	8 (35%)
Alternate days	18	15 (83%)
Weekly once	22	21 (95%)
Monthly once	11	9 (82%)
Never	26	26 (100%)
Total	100	79 (79%)
<u>Chemical used to clean stethoscope</u>		
Sterillium	70	50 (71%)
Chlorhexidine	4	3 (75%)
Never cleaned	26	26 (100%)
Total	100	79 (79%)
<u>Adherence of cleaning practices of stethoscope</u>		
After using with patients	53	47 (89%)
Before using to patients	37	32 (87%)
Both the times	10	0 (0%)
Total	100	79 (79%)

<u>Do your stethoscope can transmit infection</u>		
Yes	77	60 (78%)
No	23	19 (83%)
Total	100	79 (79%)
<u>Mode of cleaning stethoscope</u>		
Only diaphragm	54	43 (80%)
Diaphragm and bell	8	5 (63%)
Diaphragm, bell and ear piece	20	16 (80%)
None	18	15 (83%)
Total	100	79 (79%)

Table: 2. Distribution of organisms isolated from the contaminated stethoscope

Type Of Bacteria Isolated	From the Diaphragm		From the Bell		From the Earpiece	
	N	%	N	%	N	%
MSSA	8	12 %	15	27 %	7	20
MRSA	13	22 %	6	11 %	3	8.5
MSCONS	12	20%	8	15 %	4	11
MRCONS	2	3 %	5	8 %	7	20
<i>Diphtheroids</i>	9	15%	4	7 %	10	29
<i>Micrococci</i>	9	15%	12	22 %	0	0
<i>Pseudomonas aeruginosa</i> (MDR)	3	5%	1	2 %	1	3
<i>Citrobacter freundii</i>	1	2 %	3	6 %	3	8.5
<i>S.aureus</i> & MRCONS	0	0%	1	2 %	0	0
MRSA&MRCONS	1	2 %	0	0	0	0
GPB & CONS	1	2 %	0	0	0	0
<i>C.frendii</i> & CONS	1	2 %	0	0	0	0

Fig. 2 shows the representation of different organisms from the stethoscope..

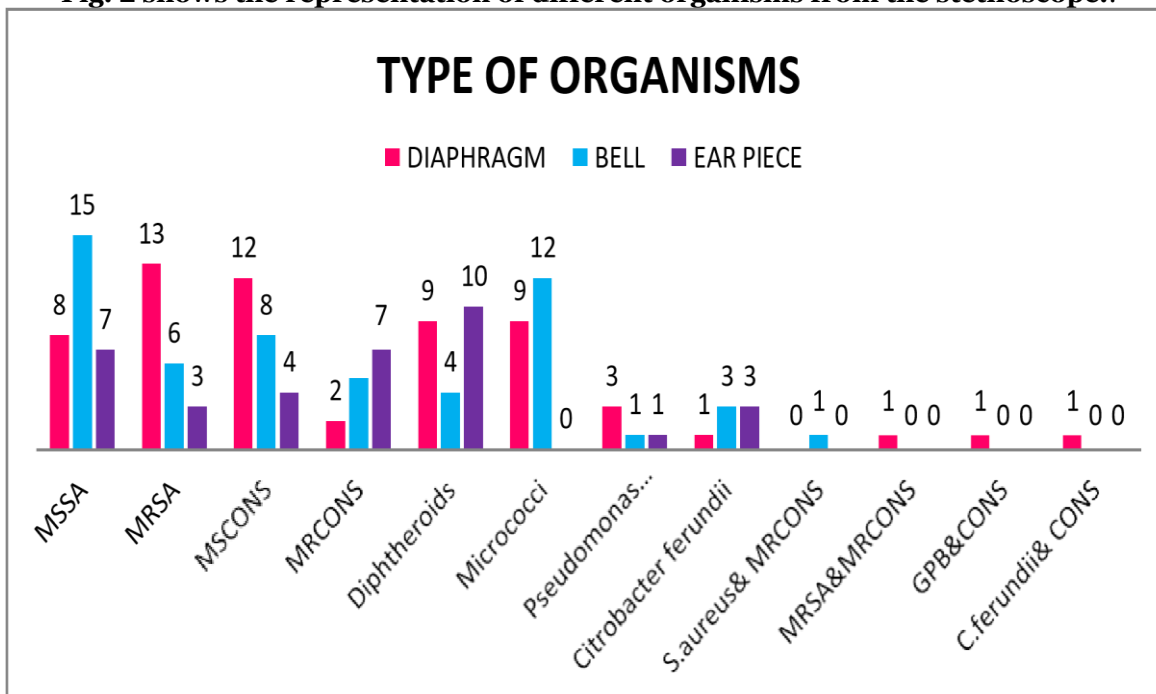


Fig 3: Representation of Multi Drug Resistance in Stethoscope:

